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Smart Multifunction Floor Cleaning Robot

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Abstract: ***The conventional floor cleaning machines is most widely used in airport platforms, railway platforms, hospitals, bus stands, malls and in many other commercial places. These devices need an electrical energy for its operation and not user friendly. In India, especially in summer, there is power crisis and most of the floor cleaning machine is not used effectively due to this problem, particularly in bus stands. Hence it is a need to develop low cost, user friendly floor cleaning machine. In this project, an effort has been made to develop a solar powered mobile operated floor cleaning machine so that it can be an alternative for conventional floor cleaning machines. In this work, modelling and analysis of the floor cleaning machine was done using suitable commercially available software. The conventionally used materials were considered for the components of floor cleaning machine. From the finite element analysis, we observe that the stress level in the mobile operated floor cleaning machine is within the safe limit.***

Keywords: Floor cleaning, Floor dryer , Arduino Uno, Bluetooth Communication, LCD display etc.

I. INTRODUCTION

Effective cleaning and sanitizing helps and protect the health of the human beings directly and indirectly. Also, cleaning and sanitizing prevents the pest infestations by reducing residues that can attract and support bees, pests etc. It also improves the shelf life of the floor, walls etc due to regular cleaning and maintenance. In recent years, most of the people prefer to use trains or buses for commuting and hence these places are littered with biscuits covers, cold drink bottles etc. Hence, it is necessary to clean the bus stands and railways stations at regular interval. There is no one single cleaning method that is suitable for all locations and occasions and effective cleaning depends upon type of cleaning device, cleaning technique and also the equipment should be user friendly. Cleaning work can be physically demanding and a need has been identified to developed methods for systematic ergonomics evaluation of new products. In recent years, floor cleaning robots are getting more popular for busy and aging populations due to lack of workers. However in India, unemployment is more and hence there is a need to develop less labour oriented cleaning machine. Hence, the present work is aimed to design, development and evaluation of a manually operated floor cleaning machine.

II. PROBLEM IDENTIFICATION

Cleaning is essential need of this generation. Basically in colleges and hospitals for floor cleaning regularly different techniques are used to clean the different types of surfaces. The reasons for floor cleaning are:

1) Injuries due to slips on the floors are cause of accidental injuries or death. Bad practice in floor cleaning is a major cause of accidents.
2) To beautify the floor.
3) Debris and obstructions are to be removed.
4) Allergens and dusts are to be removed.
5) Surfaces wear to be avoided.
6) To make the environment sanitary (kitchens).
7) Traction should be maintained at optimum level, so that no slip will occur.

The dust or water present on the floor is scrub by the front two brushes. This dust and water is collected by the vacuum cleaner and the detergent water is sprayed on the floor the mope present in the middle section of the chassis perform rotary motion on the floor which cleans the dirt or dust. The remaining water on the floor is wiping by the wiper present in end of the cleaning machine.

III. OBJECTIVE

1) To develop a mobile operated cleaning machine that helps in easy and quick.
2) To provide the alternative method for road cleaning.
3) To reduce human efforts.
4) To save the time.

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5) To reduce the cost.
6) To prevent injuries due to tripping or slipping. Injuries due to slips and trips on level floors are a major cause of accidental injury or death. Bad practice in floor cleaning is itself a major cause of accidents.
7) To beautify the floor.
8) To remove stains dirt.
9) To remove grit and sand which scratch and wear down the surface.
10) To remove allergens, in particular dust.
11) To make the environment sanitary
12) To develop solar powered multifunction floor cleaning machine.

IV. LITERATURE REVIEW

A. *Akash Nagtode(2017)*

"Solar operated floor cleaning machine. He had made a project on cleaning system based on solar power. For this he has used Pv panel which convert particle of energy (photons) into electricity. He use this clean energy to power his cleaning machine".

B. *M Ranjit Kumar (2016)*

"The regular floor cleaning machines is most generally utilized as a part of airplane terminal stages, railroad stages, healing centers, transport stands, and shopping centers and in numerous other business places. These gadgets require an electrical vitality for its activity and not easy to use. In India, particularly in summer, there is control emergency and the vast majority of the floor cleaning machine isn't utilized successfully because of this issue, especially in transport stands. In this work, demonstrating and investigation of the floor cleaning machine was finished utilizing appropriate financially accessible programming. From the limited component investigation, we watch that the feeling of anxiety in the physically worked floor cleaning machine is inside as far as possible".

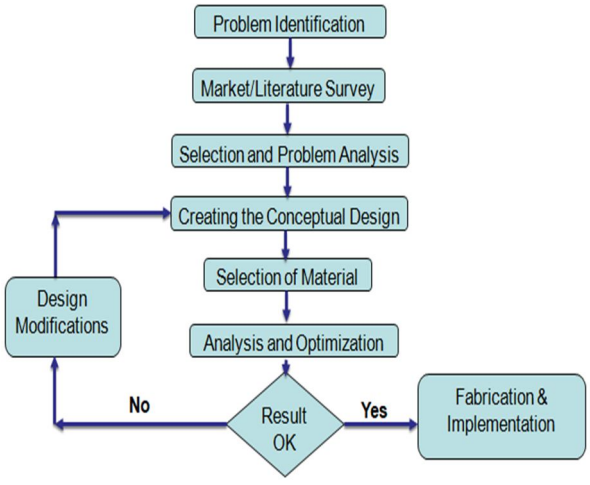
C. *Sandeep. J. Meshram ET AL [2016]*

"Design and Development of Tricycle Operated Street Cleaning Machine" – He has developed the street cleaning machine by tricycle operated. In this research article .He framed a model especially for rural area. He concluded that the cleaning is less effective in streets".

D. *Mohsen Azadbakht Etal [2014]*

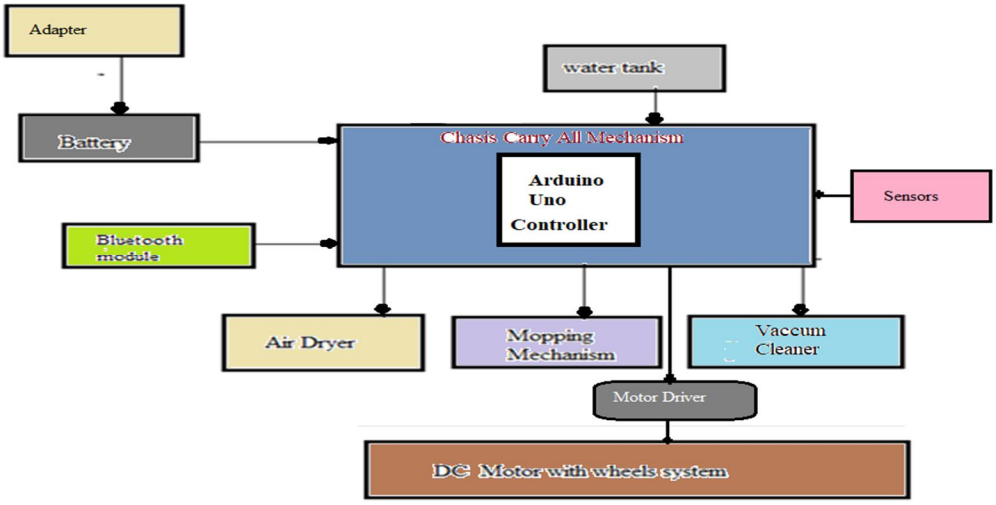
"Design and fabrication of a tractor powered leaves collector machine equipped with suction-blower system"- "The authors explained about the fabrication of leaves collector machine by tractor powered blower. He has frame the machine by using chassis, pump, blower, gearbox, hydraulic jack. They concluded total power consumption of that machine is around 14634 W which can cover up to 20m range in distance".

V. METHODOLOGY



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VI. BLOCK DIAGRAM



VII. WORKING

When adapter of 12v is applied and their electric energy stored in battery. 12v DC battery supply is provided to the electrical switch board of the machine. The main supply from electrical board is supplied to vacuum cleaner, during working DC is supplied to the vacuum cleaner and Adapter.

Vacuum cleaner is used to operate the d.c motors which performs a key role in cleaning operation. There are three D.C motors one is used to rotate the mop for cleaning the middle surface that is covered by the chassis.

The DC motor used for rotation of the mop having high torque than the motor used for the driving. The other two DC motors having high RPM are used to move the robot in the front section. At same time air dryer is used to dry floor instantly.

During summer season the uneven particles which collects on the surface of the floor are clean through the front cleaner machine and from the middle slots the mopping will clean floor. During the dry cleaning the supply of water is disconnected.

All operation controlled from Smartphone through Bluetooth technology. Sensors attached to robot is help to detect any obstacle, buzzer attached to controller is On active of sensors.

The components used in system is Arduino uno controller , LCD display , Relay board , Motor Driver , DC motor , DC pump , Sensors , Vacuum cleaner , Air dryer etc.

VIII. COMPONENTS & SOFTWARE USED

1) Adapter
2) Battery
3) Bluetooth module
4) Arduino Uno
5) Relay Board
6) IR sensor
7) Motor Driver
8) DC Motor
9) Vacuum cleaner
10) Dc water pump
11) Wheels
12) Frame
13) LCD display
14) Mop
15) Air Dryer
16) Sensors
17) Others

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A. Software Specifications

1) Arduino Compiler

2) MC Programming Language: C

IX. COMPONENTS SPECIFICATION

A. Arduino Uno (12v)

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.



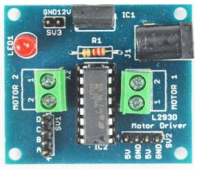
*B. LCD Display (16*2)*

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures.



C. Motor Driver

A motor driver is a current amplifier, the performance of motor drivers is to grasp a low-current control signal and then turn it into a higher-current signal that can run a motor. In Fig is the L293D Motor Controller.



D. Bluetooth module (HC-05)

HC-05 module is simple to use Bluetooth SPP (Serial Port Protocol) module, designed for clear wireless serial connection format.



E. Dc motor (60 RPM)

Robot is an electromechanical sleight which reacts in environment in one or some other way. Decisions and actions taken by its autonomous to do a particular work.



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F. DC Pump

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 12 volts of DC power.



G. Wheels

It used to drive the whole machine. As the High torque motor attached to wheels, when button is pressed whole system runs automatically.



H. Vacuum Cleaner (12v DC)

Universal motor is generally used for suction in vacuum cleaners. It is a series DC-motor that is designed to operate on AC as well as on DC.



I. Floor Dryer

It is used to dry the floor instantly. It operates on 12v DC.



J. REALY Board

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit.



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K. Battery

12 V , 2 Amp Battery is high power battery easily handle all the function. Main things are to collect electrical energy from solar panel and provide to various components For running specific function.

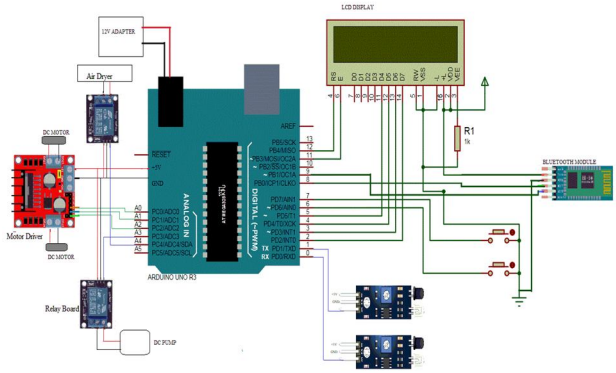


L. IR sensor

The IR sensor module consists mainly of the **IR Transmitter and Receiver**, Op-amp, Variable Resistor (Trimmer pot), output LED along with few resistors. IR LED Transmitter. IR LED emits light, in the range of Infrared frequency.



X. CIRCUIT DIAGRAM



XI. ADVANTAGES

A. Manual effort is reduced:
B. Operating time is less:
C. Cleaning and polishing can be done at same time:
D. Power consumption is less:
E. This machine requires low Maintenance cost.
F. In this machine Easy control of cleaning solution supply by controlling valve.
G. It can be used on various places other than rough surfaces.
H. By further modification the drive or movement can be made automatic

XII. DISADVANTAGES

A. Floor cleaning machine produces vibrations when used on rough floors or rough surfaces.
B. Floor cleaning machine is Suitable for only flat surfaces.
C. Floor cleaning machine is Semi-automated machine.
D. It is heavy to lift.
E. It is not capable to clean stair of any building.
F. Maintenance of mop is required.

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XIII. APPLICATIONS

1) Hospitals – floor cleaning machines are used in hospitals for both wet and dry cleaning. In order to obtain hygienic surface.
2) Computer centers – To maintain the desired cleaning surface finish.
3) Colleges – it is mainly used to clean the dust which is collected on the surface.
4) Railway station– On the platform of the railway station it can be used in any seasons.
5) Auditoriums & Malls
6) Cinema Halls.

XIV. OUTCOMES

In our project we introduced a floor cleaning robot capable of performing both vacuum and mopping. The main motive of the project is to cover the aspects of cleanliness in the society. The multiple applications provide a wide range of functions in which we can clean the pipe, scrubbing of surface for proper cleaning of the floor, remove dust and dirt from the road. This project is very helpful for the society and plays a vital role in cleanliness of the country.

XV. RESULTS AND DISCUSSION

Present work is aimed at working of an manual motion controlled machine that could clean the floor of normal Indian house-hold as well as public places. Proper cleaning is achieved by motion of the mopping which is relatively rotational in manner. The cleaning process is carried out by making the floor wet and mopping it and again making the floor dry. The floor should be dry after the process is complete because wet floor leads to different sort of problems as discussed above. For this purpose water pumps are to be used. The cleaning also meet challenges like which type of debris it will meet. This leads to proper cleaning when heavier particles are there as debris particle. Thus leading to proper cleaning of the surface. There may be oily surfaces in some cases. To counter act this situation necessary disinfectants are to be used. wheel drive mechanism should be used for proper control of the machine. To control all the motors and water pumps basically control board type is used. For completing the motion all over the surface spiral mechanism and particle swarm optimization method is being utilized. Basically we are to design a portable machine that could move manually all over the floor surface and cleaning the floor.

XVI. PROJECT IMAGE



XVII. FUTURE SCOPE

If panel used of high watt, then the machine can be used during night time for garden lighting or room lighting. Because we can store more power. And at night time however you keep it aside. So the power in the battery can be used for this purpose. By using one valve in the pipe we can also use it for gardening i.e. pouring water for plants. By connecting one box type carrier we can use it to transport files, books or other stuffs from one place to other in office or any other place.

XVIII. CONCLUSION

The use of innovative technology not only reduces cost significantly but also reduces the human effort while increasing the effectiveness of floor cleaning. Reduced human effort means more frequent floor cleaning which results in increase in overall cleanliness and supports healthy well-being. Small steps in technological advancement like this will have higher impact in long run in future, making India a better country.

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A. Project Code

```
#include <LiquidCrystal.h>
#include <stdio.h>
LiquidCrystal lcd(6, 7, 5, 4, 3, 2);
char gchr='x';
int sti=0;
String inputString = "";         // a string to hold incoming data
boolean stringComplete = false;  // whether the string is complete
int m1a       = 8;
int m1b       = 9;
int m2a       = 10;
int m2b       = 11;
int m3a       = 12;
int m3b       = 13;
int m4a       = A1;
int m4b       = A2;
int relay     = A0;
void okcheck0()
{
  unsigned char rcr;
  do{
      rcr = Serial.read();
    }while(rcr != 'K');
}
void setup()
{
 Serial.begin(9600);serialEvent();
// mySerial.begin(9600);
 lcd.begin(16, 2);
  lcd.print(" Smart Agribot");

   pinMode(m1a, OUTPUT);
   pinMode(m1b, OUTPUT);
   pinMode(m2a, OUTPUT);
   pinMode(m2b, OUTPUT);
   pinMode(m3a, OUTPUT);
   pinMode(m3b, OUTPUT);
   pinMode(m4a, OUTPUT);
   pinMode(m4b, OUTPUT);
   pinMode(relay, OUTPUT);

  // initialize serial:
   digitalWrite(m1a, LOW);
   digitalWrite(m1b, LOW);
   digitalWrite(m2a, LOW);
   digitalWrite(m2b, LOW);

   digitalWrite(m3a, LOW);
   digitalWrite(m3b, LOW);
   digitalWrite(m4a, LOW);
```

```
  digitalWrite(m4b, LOW);
  digitalWrite(relay, LOW);

 //serialEvent();
}
void loop()
{
delay(1000);
}
void serialEvent()
{
 while (Serial.available())
      {
       char gchr = (char)Serial.read();

        if(gchr == '8')
  {gchr='x';
   digitalWrite(m1a, HIGH);digitalWrite(m1b, LOW);
   digitalWrite(m2a, HIGH);digitalWrite(m2b, LOW);
   lcd.clear();lcd.print("Front ");
  }
 if(gchr == '2')
  {gchr='x';
   digitalWrite(m1a, LOW);digitalWrite(m1b, HIGH);
   digitalWrite(m2a, LOW);digitalWrite(m2b, HIGH);
   lcd.clear();lcd.print("Back ");
  }
 if(gchr == '4')
  {gchr='x';
   digitalWrite(m1a, HIGH);digitalWrite(m1b, LOW);
   digitalWrite(m2a, LOW);digitalWrite(m2b, HIGH);
   lcd.clear();lcd.print("Left  ");
  }
 if(gchr == '6')
  {gchr='x';
   digitalWrite(m1a, LOW);digitalWrite(m1b, HIGH);
   digitalWrite(m2a, HIGH);digitalWrite(m2b, LOW);
   lcd.clear();lcd.print("Right ");
  }
 if(gchr == '0')
  {gchr='x';
   digitalWrite(m1a, LOW);digitalWrite(m1b, LOW);
   digitalWrite(m2a, LOW);digitalWrite(m2b, LOW);
   digitalWrite(m3a, LOW);digitalWrite(m3b, LOW);
   digitalWrite(m4a, LOW);digitalWrite(m4b, LOW);

   digitalWrite(relay, LOW);

   lcd.clear();lcd.print("Stop ");
  }
```

```
if(gchr == 'C')
  {gchr='x';
   digitalWrite(m3a, HIGH);digitalWrite(m3b, LOW);
  }
if(gchr == 'E')
  {gchr='x';
   digitalWrite(m4a, LOW);digitalWrite(m4b, HIGH);
  }

 if(gchr == 'D')
  {gchr='x';
   digitalWrite(relay, HIGH);
  }
      }
}
```

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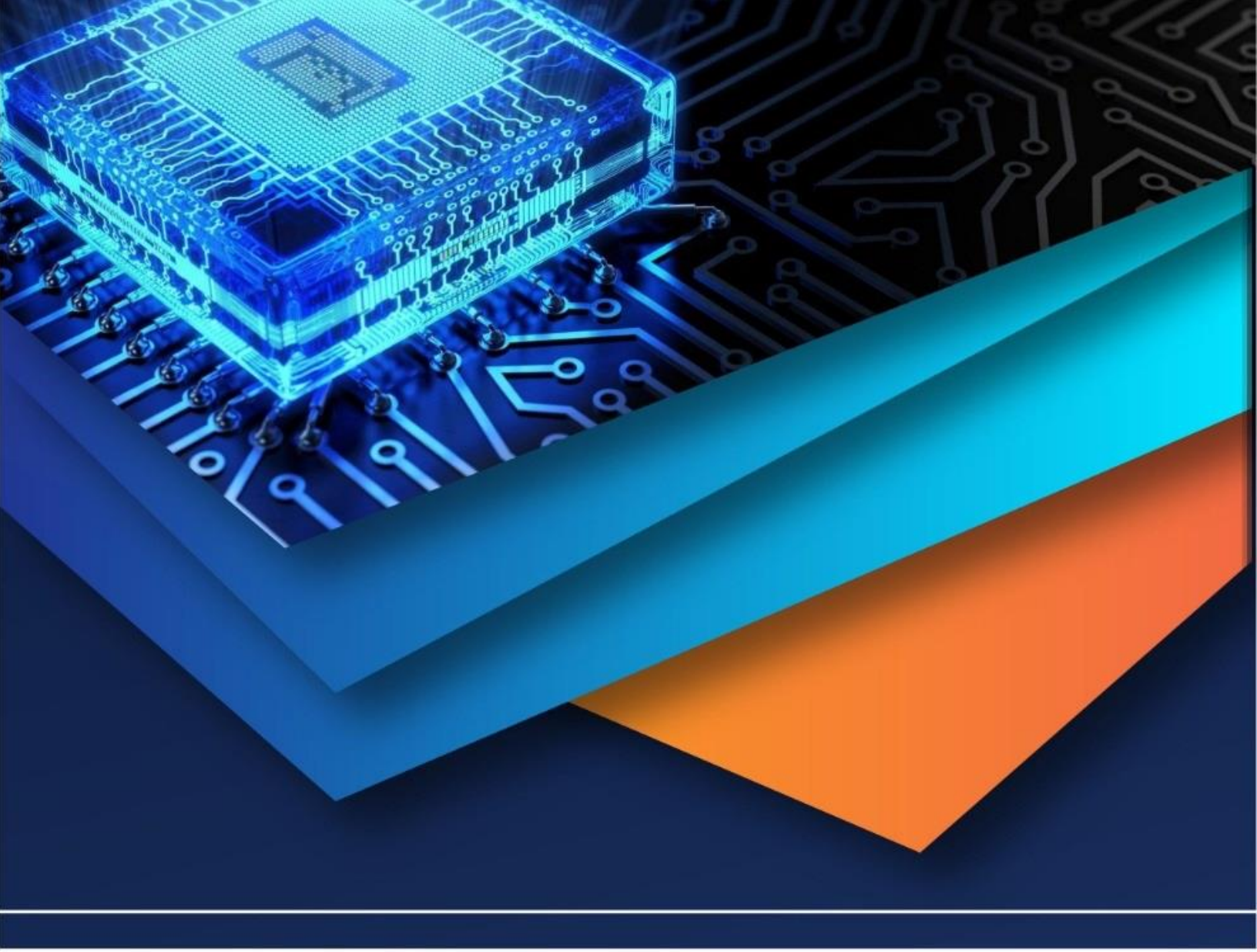
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